

ABSTRACT

Embodiments include a process and composition for improved capacity retention of a lithium-ion battery. Embodiments include a surface/chemical modification of electrode materials. In certain embodiments the LiMn_2O_4 spinel oxide is modified with Li_xCoO_2 , $\text{Li}_x\text{Ni}_{0.5}\text{Co}_{0.5}\text{O}_2$, Al_2O_3 , Cr_2O_3 , MgO , MgAl_2O_4 or combinations thereof using a chemical processing procedure followed by heat treatment. The surface/chemically modified LiMn_2O_4 show an improved capacity retention at room temperature and at elevated temperatures. In certain embodiments, $\text{Li}_x\text{Ni}_{0.5}\text{Co}_{0.5}\text{O}_2$ -modified LiMn_2O_4 demonstrates improved capacity retention. In other embodiments, Al_2O_3 -modified LiMn_2O_4 demonstrates a higher capacity under certain conditions. In other embodiments the $\text{Li}_{0.75}\text{CoO}_2$ -modified LiMn_2O_4 demonstrates a combination of improved capacity value and retention. In another embodiment the LiCoO_2 layered oxide is modified with Al_2O_3 or $\text{Li}_{1.05}\text{Mn}_{1.9}\text{Ni}_{0.05}\text{O}_4$ using a chemical processing procedure followed by heat treatment. The surface/chemically modified LiCoO_2 shows much higher capacity of approximately 190 mAh/g in the range of 4.5 to 3.2 V with good capacity retention.